AAM, 06/28/00

Some information about current achievements in light yield in WLS fiber technique

1. B.Bolen et al. (University of Missisipi) Study of wave-shifting fibers for Scintillating Barrel calorimeter for the GEM detector at SSC. Achieved the best number of p.e. of 10.7 for cosmic ray muons per 8mm thick plastic scintillator (Kuraray), so it can be projected to **13.4 p.e.** for 1 cm thick.

2. R.Wojcik et al. (CEBAF) Study of embedded wave-shifting fiber readout with plastic scintillators. The best result is 6.7 p.e. for 1 MeV electron, which can be projected for 2 MeV energy loss (muon loss in 1cm thick plastic) to **13.4 p.e.** (surprisingly good coincidence with previous group!). It was obtained with BC414 – BCF92 and the same number for BC404/BCF92 is 6.5, and for BC408/BCF91 (our case) is 5.2

3. S.Aota et al. (plug calorimeter for CDF). A Scintillating tile/fiber system for the CDF plug upgrade EM calorimeter. Results: Multiclad fiber gives 43% more light than single clad. It is not clear their final result for mips. In the abstract they give the light yield of "larger than 3 p.e." for 4 mm thick plastic, which corresponds to **7.5 p.e.** in 1cm thick plastic. But in the developments they give the best number of ~7.5 p.e. , or **18.8 p.e.** per 1 cm (not sure)

4. G.Aguillion et al. (OPAL experiment at CERN). Give the best results of **14 p.e.** for 1cm thick BC408

5. Wave-shifting bar (HEXTE, P.Hink et al.) Bar views one full side of plastic sheet. Give 31.3 p.e. for 1.2cm thick BC414, which corresponds to **26 p.e.** for 1cm thick, as the best result, using same technique of the measurement as we use in the lab (width of the pulse-height distribution is given by statistical fluctuation of the number of p.e.). Cleaning the measurements, they report 37 p.e. for 1.2cm thick, or 30.8 p.e for 1cm thick

<u>Our BTEM design:</u>

1. 1cm thick BC408 with 1mm round BCF91A/MC (multiclad fibers)
2. 1.2 deep grooves
3. No aluminum on the fiber dead end
4. 1cm fiber spacing
5. TYVEK wrapping

Possible ways for the light yield improvement, suggested in papers:

1. 2 fibers per groove
2. increase of the fiber length in the tile (use sinusoidal patter) – I think should have the same effect as running more fibers with reduced spacing
3. Dope WLS fibers by scintillator, use thicker fibers
4. Use combination of BC414/BCF92
5. Aluminum sputtering of the fiber ends (improves light yield by ~ 50%, Bolen et al.)
6. Deep grooves (2.5-3mm for 1mm fibers)